REMARKS/ARGUMENTS

Applicant responds herein to the Office Action dated January 10, 2006.

Claims 1-3 and 5-21 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hu et al., US 2003/0157773 A1, in view of Wolf and Tauber, Silicon Processing for the VLSI Era Volume 1: Process Technology. Reconsideration of the rejection is respectfully requested.

Independent claim 1 provides, in part, for, "[a] method of manufacturing a semiconductor device, comprising the steps of: ... thermally oxidizing the oxide film in a gas atmosphere containing oxygen; wherein the temperature during said thermally oxidizing step is higher than the temperature of all other processes performed later in the manufacture of the semiconductor device than said thermally oxidizing step."

The Examiner admits that, "Hu does not explicitly shows wherein the temperature during the thermally oxidizing is higher than the temperature of any other process performed later than the thermally oxidizing," (Office Action, page 2, paragraph 3, lines 1-2). The Examiner contends, however, that, "Wolf and Tauber ... discloses that at 900°C unwanted doping will occurs and that processes should be done at no higher than 900°C. Also, if processes are higher, they should be done by RTP, which is typically 1100°C (page 57)," (Office Action, page 2, paragraph 3, lines 3-6). The Examiner further states that, "It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the RTP of Hu be the highest temperature of the entire process, since, it is carried out at 1100°C and, according to Wolf and Tauber, at temperatures higher than 900°C unwanted doping will occur," (Office Action, page 3, lines 1-4). It is respectfully submitted that the disclosure of Wolf and Tauber, cited by the Examiner, does not supply the admitted deficiency of Hu.

Wolf and Tauber merely discusses the process temperatures for doped-impurities and contact sintering. Neither of the references teach nor suggest anything about the relationship in process temperature between the thermally oxidizing step and any other processes that are to be performed later. Wolf and Tauber does not teach or suggest the relationship in process temperature between the thermally oxidizing steps and any other processes that are to be

performed later, either. Therefore, it is apparent that the feature of the claimed invention would never be derived from teachings of Hu and Wolf/Tauber in any way.

Furthermore, page 57 of Wolf and Tauber does not indicate a typical temperature of RTP at 1100°C. On page 58 of Wolf and Tauber a wide range of temperatures is indicated as a desirable option in RTP systems "since the thermal processes that can be carried out by RTP extend from 420-1150°C," (page 58, lines 14-15). Thus, it is respectfully submitted that there is no support for the Examiner's conclusion that the RTP of Hu be the highest temperature of the entire process since, as Wolf and Tauber indicate, "the thermal processes that can be carried out by RTP extend from 420-1150°C," not 1100°C, as stated by the Examiner.

Since claims 2-3 and 5-12 are directly or indirectly dependent upon independent claim 1, they are allowable over Hu et al. in view of Wolf and Tauber for the same reasons recited above with respect to the allowability of independent claim 1 over Hu et al. in view of Wolf and Tauber.

With respect to independent claim 13, the Examiner "submits that the specification of the instant application does not disclose, teach or even suggest that the concentration of nitrogen is non-uniform. In fact, the specification, in particular, figure 6 shows an exponential graph of the concentration of nitrogen versus the depth of the oxide layer, which is similar in representation to that of Hu," (Office Action, page 5, paragraph 18, lines 3-6). Applicant respectfully disagrees with the Examiner, and traverses the Examiner's argument.

In particular, it is respectfully submitted that the meaning of the phrase in independent claim 13, that "the nitrogen concentration in the oxide film is nonuniform" is that the concentration of nitrogen is <u>not constant</u>, independent claim 13 stating that such concentration is nonuniform with respect to a depth in the oxide film. Figure 6, cited by the Examiner to show that the instant application does not disclose that the concentration of nitrogen is nonuniform, in fact, <u>proves the opposite</u>, namely, that the concentration of nitrogen is nonuniform or <u>not constant</u> with respect to depth. This is further described in the specification where it is stated that, "The line (a) in FIG. 6 shows a nitrogen profile in the case where nitrogen is introduced into a silicon oxide film having a thickness of 15 Å under the above-described conditions. It can be

seen that nitrogen is segregated on the surface in a large amount, and that the nitrogen amount becomes less toward the silicon substrate interface. For example, at a point 10 Å inside from the surface, the amount of nitrogen is about 1/9 of that of the surface," (page 19, lines 9-17; emphasis supplied).

With regard to Hu, the Examiner contends that Figure 6 therein shows that the nitrogen concentration is non-uniform, (Office Action, page 2, paragraph 2, lines 4-5). However, Figure 6 in Hu et al. shows the nitrogen concentration over a depth greater than just the dielectric layer, which is specified to have a thickness of 22 Å, (paragraph [0029], lines 1-9). In fact, Hu expressly indicates that, "FIG. 6 illustrates the uniformity of nitrogen atom concentration of dielectric layer 20 of FIG. 5," (paragraph [0030], lines 1-2). In contrast, independent claim 13 provides that "the nitrogen concentration in the oxide film is nonuniform with respect to a depth in the oxide film, said depth being measured perpendicularly to the interface between the semiconductor substrate and the oxide film."

Since claims 14-20 are directly or indirectly dependent upon independent claim 13, they are allowable over Hu et al. for the reasons recited above with respect to the allowability of independent claim 13 over Hu et al.

With regard to independent claim 21, that claim provides for a "semiconductor device comprising: a semiconductor substrate, a gate oxide film formed on the semiconductor substrate, and a gate electrode formed on the gate oxide film, the gate oxide film having a first portion on side of the semiconductor substrate and a second portion on side of the gate electrode, each of the first and second portions containing nitrogen therein, the second portion being higher in concentration of nitrogen than the first portion, and nitrogen in the second portion being free from substantial distribution into the gate electrode," (emphasis supplied). Since independent claim 21 provides that the second portion of the gate oxide film has a higher concentration of nitrogen than the first portion of the gate oxide film, the arguments previously stated with regard to independent claim 13 apply as well to independent claim 21, the difference in concentration of nitrogen in two portions of the gate oxide film implying the nonuniformity of nitrogen concentration in that film, similar to the feature of independent claim 13.

Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Hu as applied to claims 1-3 and 5-18 above. Reconsideration of the rejection is respectfully requested.

Since claim 4 is directly dependent upon independent claim 1, it is allowable over Hu for the same reasons recited above with respect to the allowability of independent claim 1 over Hu.

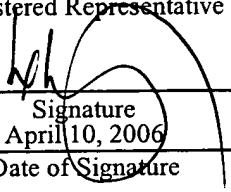
In view of the foregoing remarks, the allowance of claims 1-21 is respectfully requested.

Accordingly, the Examiner is respectfully requested to reconsider the application, allow the claims and pass this case to issue.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on April 10, 2006

Max Moskowitz

Name of applicant, assignee or Registered Representative

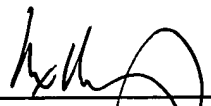


Signature

April 10, 2006

Date of Signature

Respectfully submitted,



Max Moskowitz
Registration No.: 30,576
OSTROLENK, FABER, GERB & SOFFEN, LLP
1180 Avenue of the Americas
New York, New York 10036-8403
Telephone: (212) 382-0700